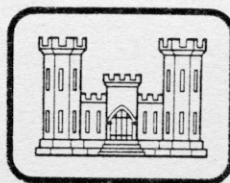# MISSOURI RIVER

MATHEMATICAL MODEL OF THE LATERAL AND LONGITUDINAL MIXING PROCESSES IN OPEN CHANNELS

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I. INTRODUCTION

This report describes the development and verification of a mathematical model of two-dimensional (lateral and longitudinal) mixing processes in steady open-channel flow. The model was developed by the Sutron Corporation for the U.S. Army Corps of Engineers, Missouri River Division, Omaha, Nebraska. Work on the model was carried out during the period January 1978 through January 1979.

The purpose of this investigation was to develop an efficient solution of the equations governing the mixing of heat or conservative constituents along and across a steady open-channel flow. An alternating direction implicit (ADI) finite-difference technique was used to develop these solutions.

The resulting model was verified using data collected by Sutron and the Corps of Engineers on the Missouri River below Sioux City, Iowa. Data on the mixing of heat and a conservative dye were collected.

The first portion of this report briefly traces the history of lateral-mixing models. Next, a complete description of the development of the ADI model is presented. The development discussion includes verification against known analytic solutions for single-boundary conditions. The final section of the report describes the verification study and results. The data acquired for the verification are presented in an appendix.

The technical contents of this report were reviewed by Dr. William W. Sayre of the Iowa Institute of Hydraulics Research, University of Iowa. Dr. Sayre also participated in the data collection for the verification study. His help and suggestions are greatfully acknowledged.